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CYCLICAL INDICATORS AND BUSINESS TENDENCY SURVEYS

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

The development of reliable statistics, oriented towards the requirements of policy-making in a market-based economy, is a priority activity in the programme of the Centre for Co-operation with the Economies in Transition (CCET). Within the framework of the CCET programme, the Transition Economies Division of the OECD Statistics Directorate has worked since 1991 with the European Commission and its Statistical Office (EUROSTAT) to develop a programme of business tendency surveys in transition countries. These surveys provide a cost-effective means of generating timely information on short-term economic developments.

This document focuses on the utilisation of information gathered by business tendency surveys for the development of reliable cyclical indicators that are used to analyse business cycles and to predict cyclical turning points in aggregate economic activity. In particular, the document outlines conceptual information and provides a detailed description of the methodologies used by OECD Member countries and by the OECD itself for the compilation of such indicators. The paper provides the background to the development of cyclical indicators in transition countries. Another document published by the OECD describes the application of these concepts in the development of cyclical indicators in Poland and Hungary (*Cyclical Indicators in Poland - 1975/1995 and Cyclical Indicators in Hungary -1980/1995*).

The methodologies used in the actual collection and compilation of business tendency survey data in transition economies is described in the OECD/CCET document, *Business Tendency Surveys in Transition Economies: Methodological Review and Recommendations for Harmonisation,1997.*

This document is published on the responsibility of the Secretary-General of the OECD.

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INTRODUCTION

Cyclical indicators systems are used by national governments and economic research institutes in various parts of the world for analysing business cycles and for predicting cyclical turning points in aggregate economic activity. Systems of cyclical or leading indicators are also maintained by international organisations for monitoring economic development across a number of market oriented countries. The aims of this paper are to: explain the concepts and measures used in cyclical analysis; describe different approaches for establishing indicator systems; and evaluate the use of business tendency surveys in cyclical analysis.

This document complements a detailed description of the methodologies used by transition countries in the actual collection and compilation of business tendency survey data described in the CCET publication, Business Tendency Surveys in Transition Economies: Methodological Review and Recommendations for Harmonisation.

The first section of this document explains the concepts of business cycles and growth cycles and describes the use of reference cycles in indicator analysis. Statistical methods used for identification of turning points and trend estimation are outlined in the second section and selection, evaluation and classification of cyclical indicators into leading, coincident and lagging indicators are discussed in the third section.

Statistical series derived from business tendency surveys are widely used as leading indicators in OECD countries and the fourth section appraises the ability of these series to serve as cyclical indicators. The criteria used to evaluate business survey series include relevance, cyclical behaviour, and practical and statistical considerations.

The fifth section describes different methods for aggregating individual cyclical indicator series into leading, coincident and lagging composite indicators. The forecasting ability and use of the OECD composite leading indicators are discussed in the final section.

Detailed information on the development of cyclical indicators in Poland and Hungary is provided in a separate paper, *Cyclical Indicators in Poland and Hungary*.

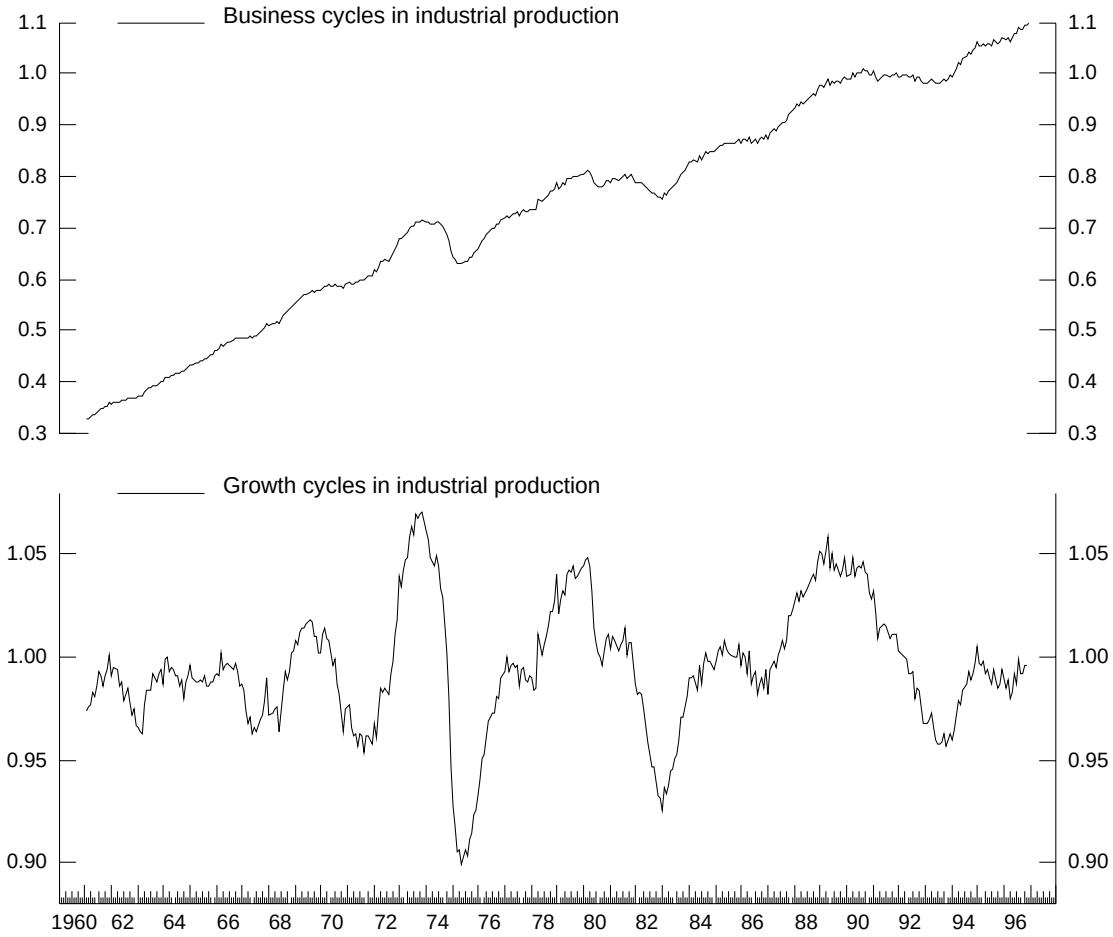
1. CYCLES

1.1 Business cycles

The technique of deriving cyclical indicators from quantitative economic statistical series relies mainly on the work of the National Bureau of Economic Research (NBER) in the United States. The NBER defines business cycles as recurrent sequences of alternating phases of expansion and contraction in the levels of a large number of economic and financial time series. These cyclical fluctuations are persistent and the duration of a business cycle as a rule lasts several years. The fluctuations show up in a great variety of time series, e.g. production, employment, investment, consumption, building, prices and monetary and financial series. The expansion phases tend to be longer than the contraction phases (recessions) in business cycles due to the general occurrence of upward long-term growth trends in economic time series in market oriented countries. Business cycles are measured from time series data containing such trends.

The index of industrial production constitutes the more cyclical part of aggregate economic activity and is used to date business cycle turning points in many countries. Chart 1 (top) shows the seasonally adjusted industrial production index for the OECD area (excluding Mexico, South Korea, Czech Republic, Poland and Hungary) with business cycle peaks (end of expansion) and the business cycle troughs (end of recession).

CHART 1 BUSINESS AND GROWTH CYCLES
OECD TOTAL AREA



1.2 Growth cycles

Growth cycles are recurrent fluctuations in the series of deviations from trend. The trend deviation series consequently display much clearer turning points than business cycles as illustrated in Chart 1 (bottom), which shows the deviations from trend of the industrial production index for the OECD area. Growth cycle peaks (end of expansion) occur when activity is furthest above its trend level. Growth cycle troughs (end of contraction/recession) occur when activity is furthest below its trend level. The trend method used here is the "phase-average-trend" method (described in Section 2.1 below).

Growth cycle contractions include slowdowns as well as absolute declines in activity, whereas business cycles contractions include only absolute declines (recessions). Peaks in growth cycles tend to occur before business cycle peaks, but troughs in growth cycles partly explained by the fact that the turning point in a series reflecting levels occurs where the slope of the trend is zero, while the turning point of the trend deviation series occurs where the slope is equal to the long-term trend. The timing difference between turning points in growth and business cycles is however not very big in practice. If the long-term trend is measured properly, in many cases the same timing is obtained, as shown in Table 1. More importantly growth cycles are more frequent than business cycles and are more symmetrical than business cycles (see Table 1).

In periods with very high long-term trends the turning points in many series reflecting levels are a poor guide to cyclical fluctuations in the economy in that the series are dominated by trend. This was the situation in much of the early post-war period in many industrialised countries. This is also the case today in the dynamic Asian economies.

High growth rates may also be expected in the future in transition countries in Central and Eastern Europe (CEECs) and the New Independent States (NISs). For this reason the concept of growth cycles is more appropriate for use in cyclical indicator systems.

Long-term trends vary over time and are difficult to measure and to keep up-to-date. It is therefore advantageous to use **first difference** series showing the rates of change of the indicators over time. Another characteristic of the first difference series is that the turning points precede the turning points of the trend deviation series. This is because they are the points of inflection of the series of levels. However, the lead of the first of the first difference series varies because its turning points may occur at different points in different cycles in comparison to the trend deviation series. This would not be a problem if business and growth cycles were perfectly regular as there would be a constant lead between the first difference series and the trend deviation series.

Another problem with the first difference series is that it is generally more volatile, even after smoothing, than the trend deviation series and this makes identification of turning points more difficult and less reliable than in trend deviation series.

Table 1: Cyclical characteristics of industrial production in the OECD area, 1960-1996

Turning points (TP)	Growth cycles			Business cycles		
	TP dates Turning point	Duration (months) Phase	Duration (months) Cycle	TP dates Turning point	Duration (months) Phase	Duration (months) Cycle
Peak	1/60					
Trough	2/61	13				
Peak	12/61	10	23			
Trough	3/63	15	25			
Peak	3/66	36	51			
Trough	3/67	14	50			
Peak	8/69	27	41			
Trough	8/71	24	51			
Peak	11/73	27	51	11/73		
Trough	5/75	18	45	5/75	18	
Peak	1/77	20	38			
Trough	2/78	13	33			
Peak	2/80	24	37	2/80	57	75
Trough	9/80	7	31	9/80	7	64
Peak	7/81	10	17	7/81	10	17
Trough	12/82	17	27	12/82	17	27
Peak	5/85	29	46			
Trough	1/87	20	49			
Peak	8/90	43	63	8/90	92	105
Trough	6/93	34	77	6/93	34	126
Peak	12/94	18	52			
Trough	3/96	15	33			
Number of Cycles			10			3
Phase average:						
Expansion (trough to peak)		24			53	
Contraction (peak to trough)		17			18	
Cycle average:						
Peak to peak			42			66
Trough to trough			42			72

1.3 Reference cycles

Cyclical indicator systems are constructed around a "reference series" or "reference chronology". The reference series is the economic variable whose cyclical movements it is intended to predict. This makes it possible to establish the timing classification of economic series as leading, coincident or lagging with respect to some pre-determined benchmark.

International indicator systems maintained by the OECD and the Commission of the European Union (EC) use a single economic variable as the reference series around which the indicator systems are built. Ideally, Gross Domestic Product (GDP) would be used as the reference series, but for many countries there is often a substantial time lag in the publication of GDP estimates and in any case they are usually available only on an annual or quarterly basis.

Indices of industrial production however are available on a monthly basis for most countries and industrial production constitutes the more cyclical part of the aggregate economy. In addition, the cyclical profiles of industrial production and GDP have been found to be closely related, so that cyclical indicators identified against industrial production serve well as indicators for the GDP cycle.

In the OECD system, the index of total industrial production is used as the reference series while in the EC system, focus is on a reference chronology based on quarterly GDP estimates.

The idea of having a single reference series or target variable is by no means universally accepted despite its obvious attraction in enabling one to be quite precise about what the leading indicators lead. The Centre for International Business Cycle Research (CIBCR) in the United States monitors growth cycles for eleven industrialised countries (Canada, US, France, Italy, Germany, UK, Japan, Australia, Korea, Taiwan and New Zealand) using a set of coincident indicators combined into a composite index as the reference series.

For each country the set of coincident indicators used includes the following series or near equivalents:

- non-farm employment
- unemployment rate (inverted)
- Gross national product or gross domestic product
- industrial production
- personal income
- manufacturing and trade sales

Personal income is however not included in the composite reference series for France, Italy and South Korea. Industrial production is not included in the reference series for New Zealand. Additional coincident indicators are used in the case of Taiwan and include domestic freight traffic and bank clearings.

In addition to the CIBCR indictors some of the following indicators are used in individual OECD countries as coincident indicators included in a composite reference series:

- use of electric power
- capacity utilisation
- cement production or deliveries
- transport of goods or passengers
- tourism (foreign visitors or nights spent in hotels)
- communication (telephone calls)
- business climate indicator (based on business survey data)

Several OECD countries however, use a single series as the reference series. In all cases the single reference series used is either quarterly or monthly (one country) GNP/GDP estimates or the monthly or quarterly index of total or manufacturing industrial production.

Having identified the reference series the next step is to identify its past cyclical behaviour. The "reference chronology", i.e. the historical cyclical pattern consists of the dates of the turning points in the reference series. The turning point dates for industrial production in the OECD area are given in Table 1. The method of determining cyclical turning points used here is the NBER method, in which the selection of a turning point must meet the following criteria:

- The phase duration (from peak to trough or trough to peak) must be at least 5 months.
- The cycle duration (from either peak to peak or trough to trough) must be at least 15 months.
- In the case of a flat turning point zone or a double peak or trough in the turning point zone, the most recent value is selected as the turning point.
- Extreme values are ignored if their effect is brief and fully reversed.

The above rules for determining turning points in a single series or a composite index series for establishing a reference chronology have been formalised and incorporated in a computerised routine (Bry and Boschan). The turning point dates shown in Table 1 have been identified by this routine which is part of the phase-average-trend computer program (described in Section 2.2 below).

2. TURNING POINT AND TREND ESTIMATION

2.1 Trend estimation

In common with most similar systems, the OECD cyclical indicator system uses the "growth cycle" or "deviation-from-trend" approach. This is necessary because essential cyclical similarities between series may be obscured by different long-term trends. Trend estimation is therefore a crucial step in detecting cyclical movements and identifying turning points.

The method of trend estimation adopted by the OECD is a modified version of the phase-average trend (PAT) method developed by the United States NBER. This method has been designed specifically to separate the long-term trends from medium-term cycles, with the latter defined according to the criteria programmed in the Bry-Boschan computer routine for selection of cyclical turning points.

The PAT of a series is estimated by first dividing the series into phases. These are defined as the number of months between successive turning points. The means of the observations in each phase are then calculated and these phase-averages are used to compute a three-term moving average. The values obtained from the moving average are assigned to the mid-point of the three-phase period, known as a "triplet", to which they refer. The trend is then obtained by computing the slope between the mid-point of successive triplets. The trend is extrapolated from the last available triplet to the end of the series by a least-squares log-linear regression starting from the mid-point of the last triplet.

The growth cycle program based on the PAT method is designed to:

- select turning points (peaks and troughs) in raw (i.e. seasonally adjusted) data or in data adjusted for long-term trend;
- measure the long-term trend and its rate of change; and
- produce trend-adjusted data.

If trend adjustment is not desired the turning point routine can be used on raw data alone thus producing a chronology of turning points in "classical cycles". With the trend-adjustment option, the program produces a chronology of "growth cycles".

The main steps in the PAT method are as follows:

- first estimation and extrapolation of long-term trend (75 month moving average);
- calculation of deviations from moving average trend;
- correction for extreme values;

- identification of tentative turning points and determination of cyclical phases, i.e. expansions and contractions (Bry-Boschan routine);

- new estimation and extrapolation of long-term trend in original series by calculation and correction of moving averages over cyclical phases (PAT trend);

- calculation of deviations from PAT trend;

- identification of final turning points in original series (Bry-Boschan routine).

2.2 Identification of turning points

The estimation of peak and trough dates is a crucial step in the PAT procedure. First estimates are made using the Bry-Boschan routine which begins by calculating a moving-average trend estimate for the identification of turning points. The routine then executes a series of tests on the deviations from this first trend estimate so as to eliminate extreme values and turning points that are judged to be too close together. The Bry-Boschan routine specifies a minimum duration of five months for a phase and fifteen months for a cycle.

These operations are applied to various smoothed curves in order to identify turning points which coincide more and more closely with observable variation in the original series. Lastly, the turning points are sought in the original series within the five months on both sides of the turning points found at the preceding stage. The points thus identified are taken as the preliminary turning points.

The main problem with the Bry-Boschan routine is that it tends to select too many turning points, thereby giving a long-term trend which is too variable. Relatively minor fluctuations may be selected by the routine and given the same weight as more important cycles. The turning points finally chosen as input to the trend calculation are selected taking into account the relationship between the variables used in the OECD indicator system. That is, care is taken to select the cyclical turning points corresponding to the reference chronology so that the trend estimation for each variable is done in a manner consistent with that for the other indicators and for the reference series itself.

The same considerations apply in making the trend estimate for the reference series. Here the main consideration is consistency between the turning points selected for a given country and the turning points for the other twenty-one countries included in the OECD system.

3. CYCLICAL INDICATORS

3.1 Selection of indicators

Once the underlying cyclical behaviour of the reference series has been established the next step is to select indicators whose cyclical movements pre-date, coincide or follow those of the reference series. The selection of indicators requires some judgement and knowledge of data sources and conceptual issues. Issues to be considered for example could include determining whether an indicator should be considered as a leading or lagging indicator for the general economic cycle or if an indicator should conform positively or inversely to the business cycle. Furthermore, cyclical indicators which perform well in one country may not work well in another because of important differences in economic structure and statistical systems. Nevertheless, a useful starting point for selecting potential cyclical indicators is to investigate some of the concepts and methods used in existing cyclical indicator systems.

In the OECD system of leading indicators candidate series are evaluated using the following criteria:

Relevance:

- economic significance -- there has to be an economic reason for the observed leading relationship before the series can be accepted as an indicator;

- breadth of coverage -- series with a wide coverage, in terms of the representation of the economic activity concerned, are preferred to narrowly-defined series;

Cyclical behaviour:

- length and consistency of the lead of the indicator over the reference cycle at turning points;

- "cyclical conformity" between the indicator and the reference series -- if the cyclical profiles are highly correlated the indicator will provide a guide, not only to approaching turning points, but also to developments over the whole cycle;

- absence of extra or missing cycles in comparison with the reference series;

- smoothness, that is, how promptly a cyclical turn in the series can be distinguished from irregular movements;

Practical considerations:

- frequency of publication -- monthly series are preferred to quarterly ones;

- absence of excessive revisions;

- timeliness of publication and easy accessibility for data collection and updating;

- availability of a long time series of the data with no breaks.

The leading indicators in the OECD system are classified in Table 2 according to five types of economic rationale which may be used as a guide for identification of potential leading indicators. The indicators are classified into the following categories:

- early stage indicators;

- rapidly responsive indicators;

- expectation-sensitive indicators;

- prime movers;

- other indicators.

The first category contains indicators which measure an early stage of production, e.g. new orders, order books, construction approvals, etc. The second contains indicators which respond rapidly to changes in economic activity such as average hours worked, profits and stocks. The third cover indicators which measure expectations or are sensitive to expectations and includes stock prices, raw material prices and expectations based on business survey data concerning production or the general economic situation. The fourth contains measures relevant to monetary and fiscal policies and foreign economic developments such as money supply, terms of trade and indicators for foreign countries. The fifth category contains indicators of mixed types such as interest rates (stimulus to both consumption and investment), overtime and layoff rate and production in specific branches.

For the countries included in the OECD indicator system the total number of indicators are rather evenly split between the different categories. Early stage indicators, expectation-sensitive indicators and prime movers represent around 20 per cent each of the total number of indicators. Rapidly responsive indicators represent around 14 per cent, whilst other indicators represent about 28 per cent of the total. The classification of the indicators is however preliminary, and gives only a rough indication of the importance of the five categories. Several of the indicators listed could be placed in more than one category.

In three of the categories: early stage, rapidly responsive and expectation-sensitive indicators, business surveys provide most of the series used. These series concern new orders, level of order books and stocks and expectations about production. Two other frequently used series in these categories are construction approvals or starts, and stock prices.

The most important series used in the prime movers category is money supply. Two series related to foreign trade and foreign economic developments are also well represented in this category, namely, terms of trade and indicators for foreign countries.

Linkage via foreign trade is generally the most important means by which cyclical impulses can be transmitted between countries. Other factors such as foreign investment, capital movements and other financial flows, tourism, etc. are, however, also important particularly in the CEECs. Leading indicator series are however difficult to find in these areas in most countries and as noted above the OECD system uses only foreign trade series as leading indicators.

Foreign trade development in one country is however dependent on economic activity in its trading partner countries and cyclical indicators in major trading partner countries may prove to be good leading indicators for the dependent country. Indicators of economic activity in foreign countries are also used in the OECD system as leading indicators in several countries. For example:

- the composite leading indicator for the United States is used as a leading indicator for Canada;

- a series on new orders in Germany and the OECD composite leading indicators for France, Germany, Italy and the United Kingdom are used as leading indicators for Austria;

- the IFO business climate indicator for Germany is used as a leading indicator for the Netherlands.

Among the other indicators listed in Table 2, the most frequently used series are different types of interest rates. Series on production in specific branches and series related to retail sales or motor vehicles registration are also frequently used. Indicators such as retail sales, employment and capacity utilisation included here would, in principle, be classified as coincident indicators but they have proved to be leading indicators in some countries.

Series on production in specific branches may be good leading indicators in many countries. A first choice would include those industrial branches which may logically be classified as affecting the early stages of production such as intermediate goods, chemicals or basic metals industries. Structural changes and export sensitivity may however make other branches a better choice. Production data disaggregated by export and domestic goods for domestic and export markets could be useful leading indicators in a country with a large export market.

Series referring to marginal employment adjustments such as overtime and lay-off rate and other labour market series such as vacancies and hours worked are not very well represented in the OECD system of leading indicators. These variables are still however worth a careful examination when searching for potential leading indicators in a country.

Interest rates and unit labour costs on the other hand are indicators representing the costs of doing business. Since a high level of costs may be associated with a slowdown in activity; these indicators are in general classified as lagging indicators. However, a low level of business cost may itself stimulate an expansion and the inverted lagging indicator would be a leading indicator for a later peak in activity.

The economic rationale for the leading behaviour of cyclical indicators, as noted above, is in most cases well understood. However, many lagging indicators, in addition to interest rates and unit labour costs, may be considered as leading indicators in inverted form. Indicators of this type include stocks, loans and deposits and may be regarded as a constraint on expansion which, inverted, may be expected to lead the business cycle.

Table 3 summarises the ways by which OECD countries classify their short-term indicators between coincident indicators (movements coincide with those of the reference series) lagging indicators (movements follow the reference series) and leading indicators (movements precede those of the reference series so that they are of particular interest for the present purpose).

It should be noted that there is not always unanimity between experts in OECD countries on the allocation of indicators between the three groups. It should be emphasised that this is a highly tentative classification and more detailed analysis would be required to determine the precise relationship, for a given country, between movements of any particular short-term indicator and the reference series.

The next step in evaluating indicator series is to assess the cyclical behaviour of the series against the six criteria listed above under relevance and cyclical behaviour. This is the subject of the next section.

The practical considerations listed above also need to be considered if the indicators are to. be used for current analysis of the business cycle. These last criteria are considered in Section 4 below which is concerned with evaluating business surveys as cyclical indicators.

Table 2: OECD leading Indicators classified by type of economic rationale

Indicator series by type of rational	Number of indicators	Percent of indicators in category
Early stage indicators		19
New orders, amounts	4	
New orders (BS)	11	
Order books (BS)	11	
Construction, approval/starts	9	
New company formation	1	
Vacancies	1	
Rapidly responsive indicators		14
Average hours worked	2	
Profits	2	
Stocks, amounts	8	
Stocks (BS)	13	
Production bottlenecks (BS)	2	
Expectation-sensitive indicators		19
Stock prices	12	
Raw material prices	2	
Selling prices (BS)	1	
Production (BS)	15	
Economic situation (BS)	6	
Prime movers		20
Money supply	17	
Deposit	2	
Exports	3	
Terms of trade	8	
Indicators for foreign countries	9	
Other indicators		28
Production in specific branches	5	
Retail sales	5	
Motor vehicle registration	5	
Layoffs/new hire/claims for unemployment benefits	3	
Price indices	4	
Unit labour costs	3	
Credit ratios	4	
Interest rates	14	
Foreign exchange holdings	2	
Foreign trade balance	1	
Capacity utilisation (BS)	2	
Employment (BS)	3	

1) Items marked (BS) are series derived from business surveys

Table 3: Classification of short-term indicators in OECD countries by economic process and cyclical timing

	Cyclical timing		
Economic process	*Leading*	Coincident	*Lagging*
Employment/unemployment	Overtime worked Secured production (BS) (Vacancies)	(Employment) (Unemployment) (Vacancies)	(Employment) (Unemployment) (Vacancies)
Production and income	Production, ex ante (BS)	GNP or GDP Industrial production Output of selected products Income Capacity utilisation	
Consumption/Trade Orders/Deliveries	New orders New orders (BS) Car registration (Bankruptcies)	(Purchase/sale of selected goods) (Bankruptcies) (Investment expenditure)	
Fixed Capital Investment	Investment orders or commitments Construction orders of commitments (Construction output)	(Construction output)	(Investment expenditure)
Inventories	(Changes in stocks) Stocks levels (BS)	(Changes in stocks) Selling prices (BS)	Stock levels
Prices/Costs profits	Raw material prices share prices (Profits) (Unit labour cost)	(Profits) (Unit labour cost)	Wholesale/ producer prices (Units labour cost)
Money/Credit	Changes in money supply Changes in saving deposits Credit commitments (Interest rates)		Loans Commercial debts (Interest rates)
Foreign position		Imports Exports	
Other indicators	Business climate (BS)	(Transport)	

1) Items in brackets are those where classification seems doubtful either because they are only mentioned by a limited number of countries or because they are classified differently by different countries.
2) Items marked (BS) are series derived from business surveys.
3) The category "Production and Income" also includes the production of specific products which it is not possible to indicate separately.

3.2 Evaluation of indicators

The performance of cyclical indicators can be evaluated a number of ways. One is to examine the behaviour of the indicators in relation to the cyclical turning points of the reference series, i.e. peak-and-trough analysis. Forecasting turning points is one of the main objectives of the cyclical indicator technique because predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting.

For peak-and-trough analysis, statistics are assembled on each series' behaviour at cyclical turning points. This includes: the mean or median leads, the mean deviation from the median and the number of extra or missing cycles when compared with the reference series. Generally, these figures are not statistically significant in the usual sense due to the limited number of turning points available over the period investigated and because most series contain irregular movements and double or multiple peaks and troughs. The median, rather than the mean, is usually used in this kind of analysis because of the relatively small number of observations. However, peak-and-trough analysis involves a substantial amount of judgement which may alter the measures significantly.

Cross-correlation analysis is used to complement the peak-and-trough analysis concerning the average lead of the indicator, and to give information about the extent to which the cyclical profiles of indicator and reference series resemble each other. This is important if the cyclical indicators are to give information about the likely rate and amplitude of movements in the reference series. Thus it is also useful to examine the "general fit" of the indicators in relation to the reference series at all stages of the cycle.

In testing the general fit, cross-correlation between lagged smoothed cyclical indicators and reference series is used. The number of months lag at which the correlation has the highest R^2 value is a guide to the average lead of the indicator over the reference series and the correlation coefficient shows the extent to which the cyclical profiles of composite indicators resemble each other. There are limitations to this method however. First, it is a measure only of the linear relationship between variables, and secondly, the presence of extreme values can affect the estimate of the cross-correlation coefficient. The second problem is, however, generally solved by using MCD-smoothed[1] series in the cross-correlation calculations.

The average lead of the cyclical indicator, as measured by the lag at which the closest correlation occurs, should not be too different from the median lag at all turning points if the composite indicator is to give reliable information both about approaching turning points as well as the evolution of the reference series.

The historical performance of the set of leading indicators and composite indicators for the United States and Germany used in the OECD system are set out in Tables 4 and 5, respectively to

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1. MCD (Months for Cyclical Dominance) is defined as the shortest span of months for which the I/C ratio is less than unity. I and C are the average month-to-month changes without regard to sign of the irregular and trend cycle component of the series, respectively. Although I remains approximately constant as the span of months increases, C should increase. Therefore, the I/C ratio, itself a measure of smoothness, should decline and eventually become less than unity.

In practice, there are some series for which the I/C ratio at first declines as the span of months increases, and then starts to increase again without ever having dropped as low 1. Hence, there is a convention that the maximum value of MCD should be six. For quarterly series there is an analogous measure, Quarters for Cyclical Dominance (QCD) which has a maximum value conventionally defined as 2.

illustrate the analytical measures and statistics used in evaluating cyclical indicators. The statistics given refer to the de-trended (ratio-to-trend) leading indicator series and reference series (industrial production). The tables contain the following information:

- extra (x) or missing (m) cycles in the indicator series with respect to the reference series;
- MCD or QCD moving average used to smooth the series, calculated on the ratio-to-trend series;
- median lag at peaks and troughs and all turning points of the indicator series with respect to the reference series, lead being denoted by a negative sign and expressed in months;
- mean deviation of the leads from the median at all turning points, expressed in months is given as a rough measure of the variability of the lead;
- cross-correlation between the MCD smoothed indicator series against the MCD smoothed reference series, the lead at which the highest correlation occurs is given along with the correlation coefficient.

United States

The group of leading indicators for the United States (set out in Table 4) contains a selection of fifteen quantitative indicators from many different subject areas (production, stocks and orders, construction, retail sales, prices, money and finance). However, only one indicator is derived from business survey data, i.e. companies reporting slower deliveries (vendor performance). The indicators are split into a shorter and a longer group, and a composite indicator is calculated for both groups. The longer-leading composite indicator includes several measures of financial conditions (money supply, treasury bill rate, share prices, sensitive prices) and construction commitments. The shorter-leading composite indicator is mainly composed of measures related to early stages in the production cycle such as new orders, stocks, deliveries, inventory to shipment ratio and net business formation.

A selection of indicators from both the shorter and longer group is used to calculate the published OECD composite indicator, but no alignment for different lead times is made.

All three composite indicators show longer average leads at peaks than troughs. The average lead is not too variable for the shorter and published composite indicator, but is relatively more variable for the longer composite indicator. The amplitudes of the reference series are well reproduced by the shorter and published indicators, but not as well captured by the longer leading indicator.

Table 4: Characteristics of OECD leading indicators for the United States 1960-1985

Indicator series	Extra or missing cycles	MCD	Median lag (+) at turning points (TP)			Mean deviation from median	Cross-correlation	
			Peak	Trough	All TP		lag (+)	coef.
Composite leading indicator, total (2-10)	1m	1	-9	3	-7	3.8	-6	.85
Composite leading indicator, long (1-6)	1m	1	-12	-6	-10	4.9	-9	.74
Composite leading indicator, short (7-15)	1m	1	-7	-1	-4	3.7	-2	.91
1. Change in liquid assets	1x	1	-6	-8	-7	5.9	-8	.39
2. Construction dwellings started	1m	3	-11	-2	-8	5.4	-8	.74
3. Change in crude material/sensitive prices	1m, 1x	6	-8	-7	-8	5.8	-8	.70
4. Money supply, M2 in 1975 prices	3m	1	-10	-4	-8	3.4	-9	.76
5. Treasury bill rate	1/2m,	3	-20	-11	-14	5.1	-19	-.68
6. Share prices, industrials	1/2x	2	-8	-4	-5	2.5	-6	.46
7. New orders durable goods	2m, 1x	3	-4	-1	-2	4.0	-1	.89
8. Change in business and consumption credit	1 m	4	-8	-2	-4	5.9	-3	.72
		3	-9	-1	-4	5.4	-3	.77
9. Net business formation	1m	3	-4	-1	-2	3.0	-2	-.87
10. Initial claims for unemployment benefits		2	-7	-1	-1	3.4	-2	-.81
11. Inventory to shipment ratio	1x	2	-3	-6	-3	4.1	-3	.71
12. Companies reporting slower deliveries (BS)	1m	3	-6	-3	-5	4.1	-2	.81
13. Sales, retail stores	1m, 1x	1	-7	-2	-5	4.9	-8	-.41
14. Stocks of finished goods		1Q	-5	0	-2	3.9	-1	.82
15. Corporate profits after tax (quarterly)								

1) Items marked (BS) are series derived from business surveys.

Germany

The group of leading indicators for Germany set out in Table 5 includes nine indicators of which four are series derived from business surveys (new orders, order books, stocks and business climate). Among the quantitative indicators, three are measures of financial conditions (money supply, yield of long term government bonds and share prices) and the other two reflect demand and costs in industry.

The average lead is longer at peaks than troughs for all leading indicators with exception of the series on money supply and share prices and the lead is longer, but more variable, for quantitative series in comparison to business survey series. The composite leading indicator, based on all nine indicators, shows a stable lead and the amplitudes of the reference series are well produced.

Table 5 : Characteristics of OECD leading indicators for Germany 1960-1985

	Extra or missing cycles	MCD	Median lag(+) at turning points			Mean deviation from median	Cross-correlation	
			Peak	Trough	All TP		lag (+)	coef.
Composite leading indicator		1	-7	-5	-6	2.0	-8	.88
1. New orders, total	1x	3	-9	-3	-7	3.5	-3	.82
2. Order inflow/demand: tendency (BS)	2x	5	-8	-4	-7	3.9	-0	.73
3. Finished goods stocks: level (BS)	1x	1	-6	-3	-5	2.2	-4	-.83
4. Order books: level (BS)		1	-6	-2	-4	2.7	-3	.84
5. Business climate (BS)	1x	1	-6	-2	-5	2.3	-8	.71
6. Labour cost, mining and manufacturing	1x	4	-6	-5	-6	4.5	-9	-.68
7. Money supply, M1 (deflated by CPI)	1x	2	-9	-14	-9	4.0	-11	.73
8. Yield of long term government bonds	2m	1	-17	-13	-16	3.5	-18	-.90
9. Share prices, industrials		2	-7	-8	-7	3.6	-9	.46

1) items marked (BS) are series derived from business surveys

4. BUSINESS SURVEYS AS CYCLICAL INDICATORS

Statistical series derived from business surveys are widely used as leading indicators in OECD countries. The type of information collected in business surveys (i.e. ordinal scales for most variables) makes them very sensitive to cyclical development. Data from business surveys have both theoretical and practical grounds for being leaders of the output cycle. This is partly explained by the motivation for design of the surveys and the fact that business surveys collect information on assessments and expectations for key economic variables. The following sub-sections examine why indicators based on business surveys are good cyclical indicators and the extent to which they fulfil the different criteria used for evaluating cyclical indicators (listed in Section 3.1 above).

4.1 Relevance

Economic rationale

Compared to traditional statistical surveys which cover only one or a few related variables from one area of the economy, business surveys collect information about a wide range of variables selected for their ability to monitor the business cycle. Priority is given to variables which measure the early stages of production (e.g. new orders, order books), respond rapidly to changes in economic activity (e.g. stocks), and measure expectations or are sensitive to expectations (e.g. overall economic situation). The fact that the surveys collect information on expectations, i.e. future developments in key economic variables make them particularly suitable as leading indicators.

The range of information covered by business surveys also goes beyond variables normally covered by classical statistics. Qualitative information may be collected for variables which are difficult or impossible to measure by conventional methods, such as capacity utilisation, production bottlenecks and views on the overall economic situation.

All variables covered by business surveys have both theoretical and practical grounds for being cyclical indicators and leaders of the output cycle. In addition, these confidence indicators reflect the assessment and expectations of businessmen, who tend to believe that neither prosperous periods nor less favourable periods can last forever.

Real versus nominal information

Cyclical indicators are normally used to monitor cyclical fluctuations in real output, To do this it is essential to use, as far as possible, series adjusted for inflation. In general, information from business surveys is collected in real terms that is respondents are asked to disregard price changes in assessments and expectations or information in direct volume terms is requested.

To show how important this is in periods of high inflation, survey data for the United Kingdom (business climate) over the period 1977-1996 and Japan (business situation) over the period 1971-1996 are confronted with real and nominal GNP data over corresponding periods in Charts 2 and 3.

CHART 2 SURVEYS AND DEVELOPMENTS IN REAL TERMS
UNITED KINGDOM

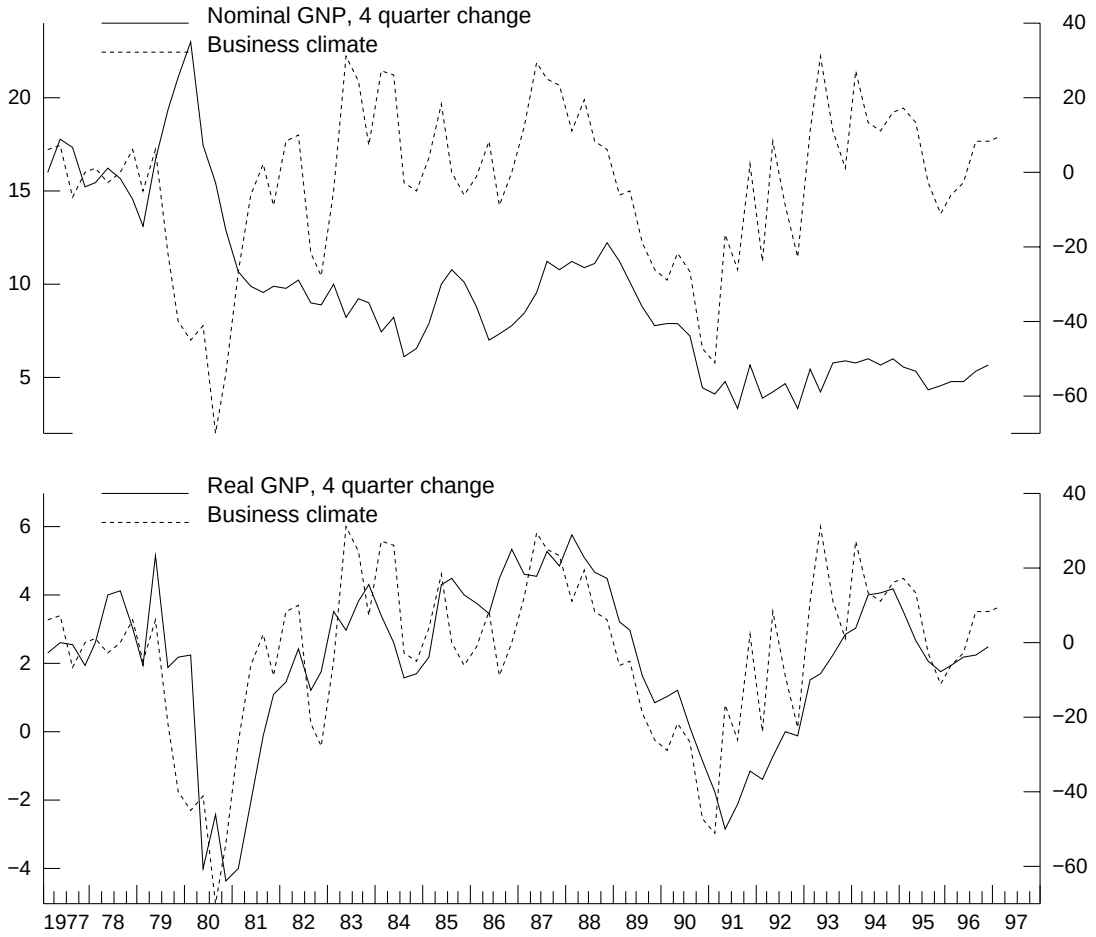
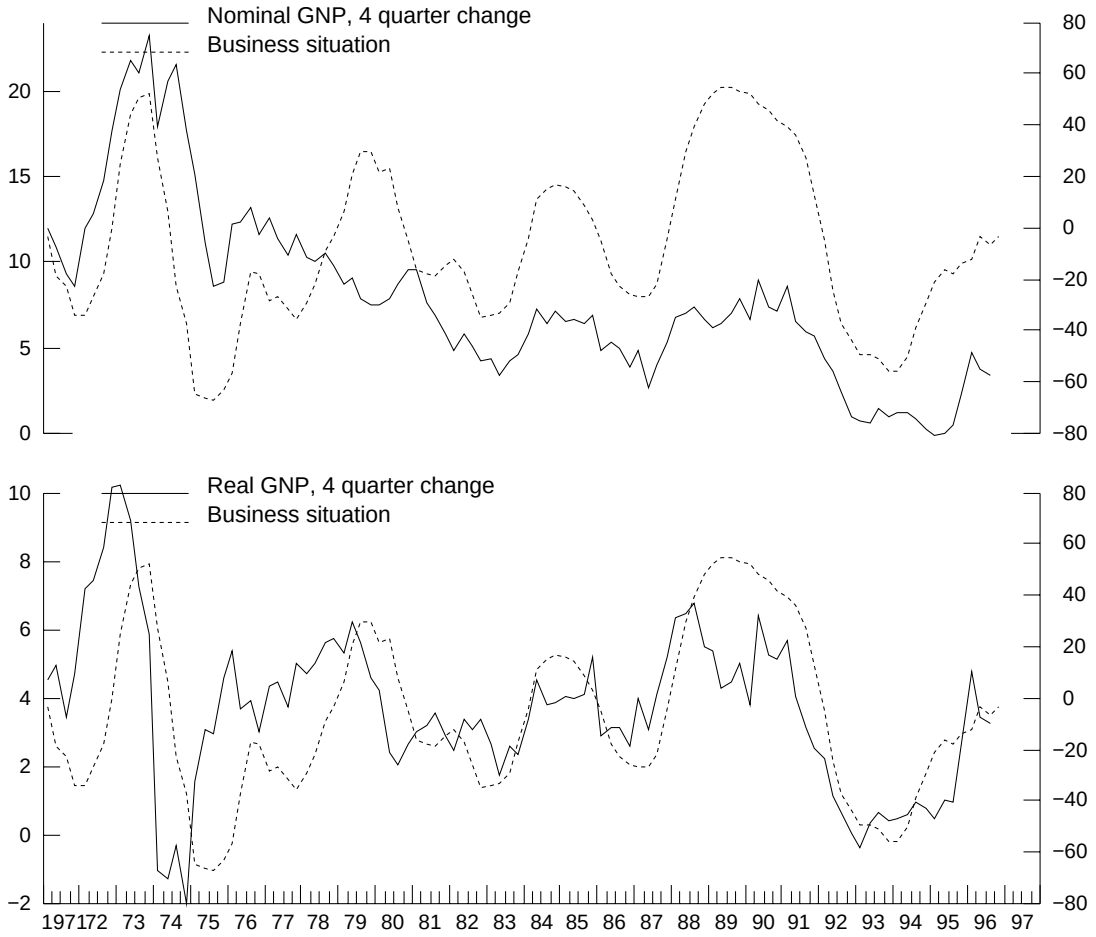


CHART 3 SURVEYS AND DEVELOPMENTS IN REAL TERMS
JAPAN



In the case of the United Kingdom, correlation of survey data against real GNP shows a correlation coefficient of 0.84 but against nominal GNP a negative value of -0.47. For Japan, the corresponding figures are 0.74 and 0.25 respectively. This comparison supports the argument that survey information reflects developments in real terms.

4.2 Cyclical behaviour

Cyclical sensitivity

The cyclical profiles of statistical series derived from business surveys are in many cases easier to detect because they contain no trend. As explained earlier, while conventional statistics focus on metric data, business surveys use ordinal scales for most variables, e.g. a three point scale with the pre-printed answers up/same/down. This makes them very sensitive to cyclical development.

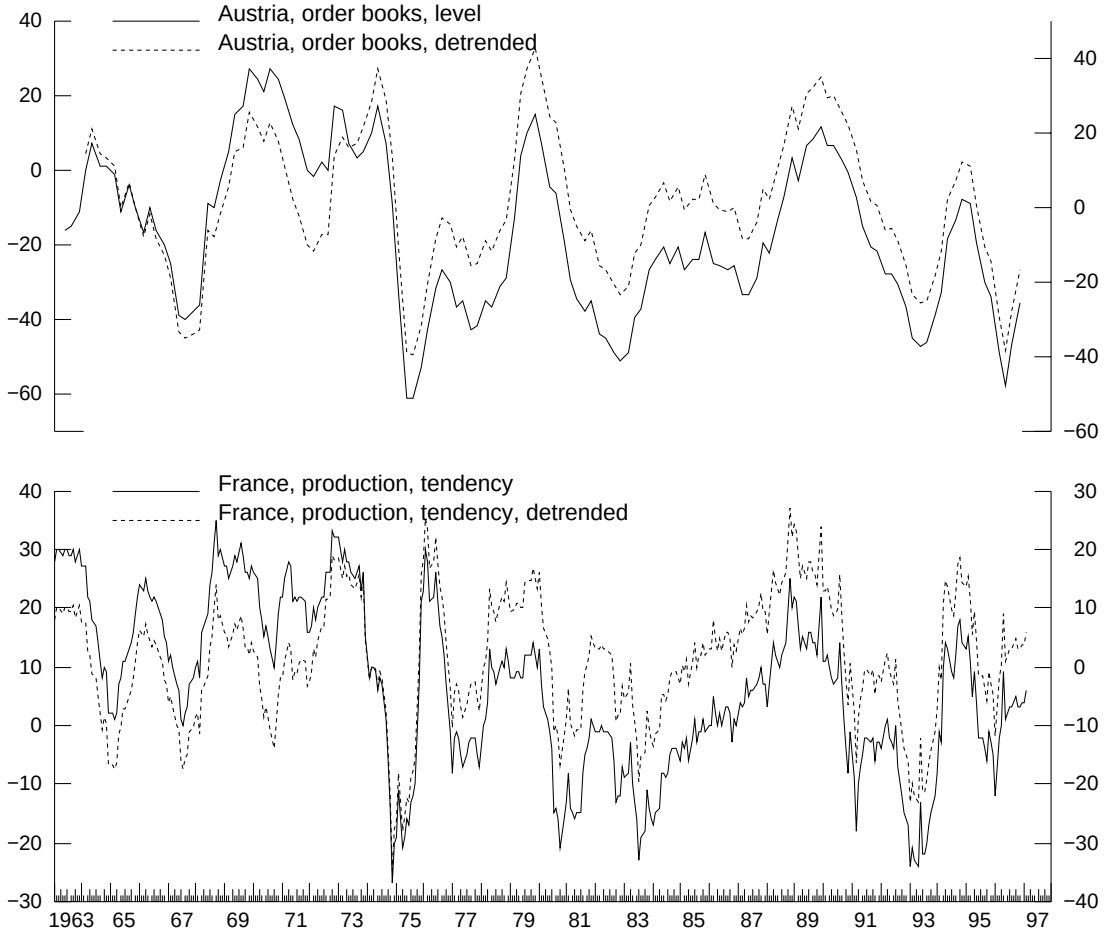
Cyclical indicators derived from business survey results are based on two main categories of survey questions based on the reply expected from the respondents. For questions asking for an assessment on present level of activity as being: above normal; non-normal; or below non-normal, the balance series or diffusion index constructed from the replies to these questions can be regarded as representing a trend deviation. For questions asking for a judgement on present or future changes or trends in comparison to past or present periods, the balance series constructed from these replies corresponds to a first difference series.

A first difference series based on business survey data can be converted to a trend deviation form by first accumulating it to a level form and then converting it to deviations about the trend in the level series. However, this type of transformation is not applied to business survey series used in cyclical analysis as leading indicator, but is of importance when comparing subjective assessments of businessmen with the objective facts represented by official statistics. The problems mentioned in the previous section concerning the use of first difference series also apply to business survey data in this form but to a lesser extent than quantitative data.

The results of business surveys are usually expressed as the balance of positive over negative answers and the resulting series are constrained to lie in the range of plus or minus 100 per cent. Series of this type should, in principle, show no change in the long-term trend. However, many business survey series in OECD countries show a change in the secular trend over longer periods, indicating a tendency of increased pessimism or optimism, with no correspondence to the state of the cycle. 'This gradual change in the trend, however, has no effect on the dating of turning point but does affect the cyclical profile of the series.

In an indicator system based on ratio-to-trend series, it is important to eliminate this change of trend in order to make the cyclical profile of the series in the system compatible with each other. This is illustrated with survey series for Austria (order books) and France (production tendency) over the period 1963-1996 in Chart 4. The order books series represents a trend deviation series while the production series corresponds to a first difference series and is related to a cyclical profile based on rate of change. However, business survey series measuring direction of change show a stable lead/lag relationship with the general economic cycle and the cyclical profiles are closely related with the deviation from trend in the reference series for the general economic cycle.

CHART 4 SURVEY DATA AND LONG−TERM TREND



Leading characteristics

All the above types of variables give early information about changes in the cyclical development. In addition, variables related to judgements and expectations register a change in the cycle earlier than corresponding traditional statistics. This is because judgements and expectations lead to plans and only after these plans have been implemented will they be picked up by traditional statistical surveys.

Business survey data for Italy on production expectations measured as direction of change over 3 to 4 months are compared with the 3 and 12 months changes in the index of industrial production and with the de-trended production index in Chart 5 to illustrate the cyclical characteristics of survey data against quantitative statistics. The survey balance series shows a peak correlation of 0.45 at zero lag against the rate of change over 3 months in the production index and a correlation of 0.61 at a lead of 2 months compared to the 12 month change in the production index. However, the balance leads the de-trended production index is 6 months with a peak correlation of 0.67. This means that the cyclical profile of the balance series is more compatible with the de-trended production index than with the corresponding rate of change series.

The results of a further test on the cyclical characteristics of business survey data in comparison with quantitative data are shown in Chart 6. Survey data for Germany on orders inflow/demand tendency measured as the direction of change over one month are compared with the changes over 1 month and 12 months in the quantitative series on new orders and with the de-trended new orders series in Chart 6. The balance series shows a peak correlation of 0.20 at 2 months lag against the one month change in the new orders series and a correlation of 0.78 at a lead of 1 month compared to the 12 month change in the quantitative series. The lead of the balance series against the de-trended new orders series is 7 months with a peak correlation of 0.70. These results indicate that the balance series reflects changes over longer periods than one month as requested in the survey. The cyclical profile of the balance series also corresponds rather well to the de-trended quantitative series.

In other words, balance series in first difference form combine the leading advantages of a rate of change series and the cyclical characteristics of ratio-to-trend series.

CHART 5 SURVEY DATA AND QUANTITATIVE DATA
ITALY

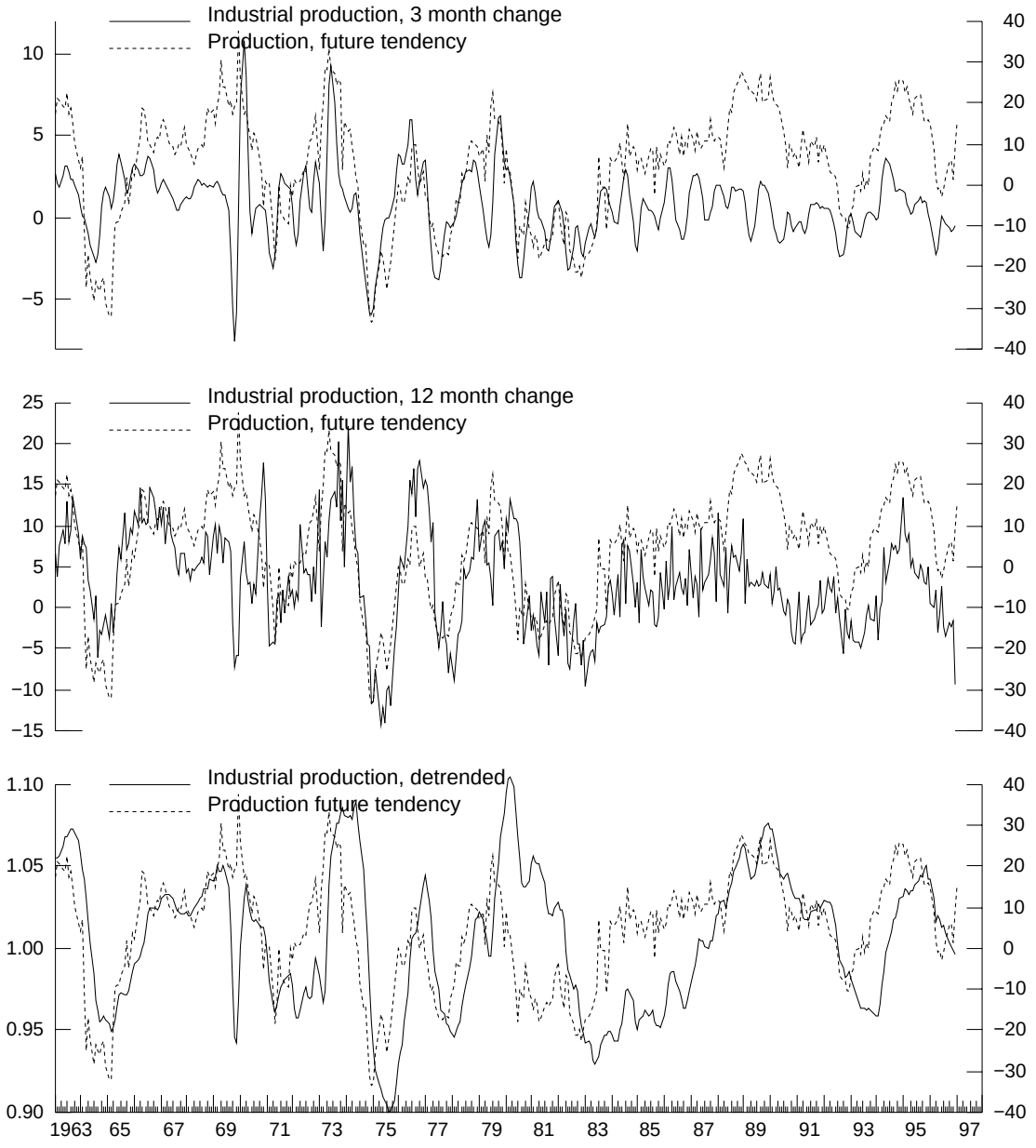
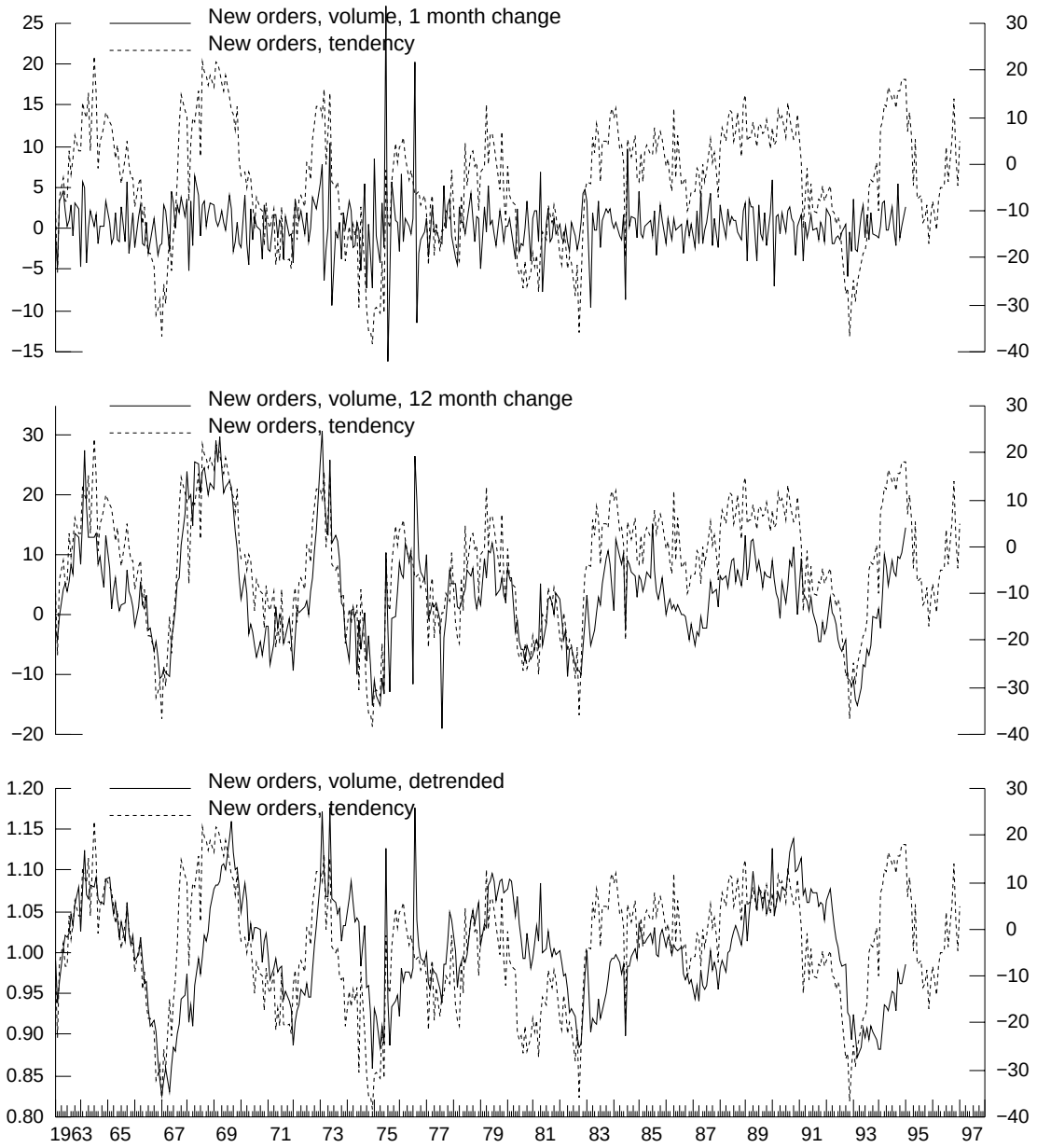


CHART 6 SURVEY DATA AND QUANTITATIVE DATA
GERMANY



Consistency of the lead

The length of the lead at cyclical turning points of business survey indicators is not among the longest compared to all types of leading indicators, the average median lead range between 3.8 to 6.5 months for the most frequently used indicators in the OECD system, however the size of the lead is more stable. The average mean deviation of the leads from the median at all turning points, expressed in months, is used as a rough measure of the variability of the lead and is set out in Table 6. In particular, business survey data on stocks of finished goods and order books show less deviation from the median lead, 3.6 and 3.1 months in comparison with all other indicators. The most unstable leads are registered for series on terms of trade and interest rates with a deviation from the median lead of 6.0 and 5.1 months, respectively.

Table 6: Characteristics of leading indicators most frequently used in the OECD system, 1960-1985

Average of indicators

Indicators	Number of indicators/ countries	MCD	Median lag (+) all turning points	Mean deviation around median	Lag (+)	Correlation coefficient
Money supply	17	2.4	-9.2	4.2	-8.2	.67
Production (BS)	15	3.3	-5.6	4.1	-6.0	.70
Interest rates	14	2.3	-13.5	5.1	-15.3	-.71
Stocks (BS)	13	2.6	-3.8	3.6	-4.3	-.74
Share prices	12	2.3	6.3	4.6	-6.6	.59
Order books (BS)	11	2.5	-4.1	3.1	-4.8	.75
New orders (BS)	11	4.0	-6.5	4.2	-8.0	.71
Construction	9	3.7	-6.4	4.6	-6.6	.60
Terms of trade	9	3.5	-9.8	6.0	-11.8	.57
Stocks	8	2.3	-6.2	4.1	-7.8	-.67

1. (1) Items marked (BS) are indicators derived from business surveys.
2. (2) MCD, median lag, mean deviation and lag are expressed in months

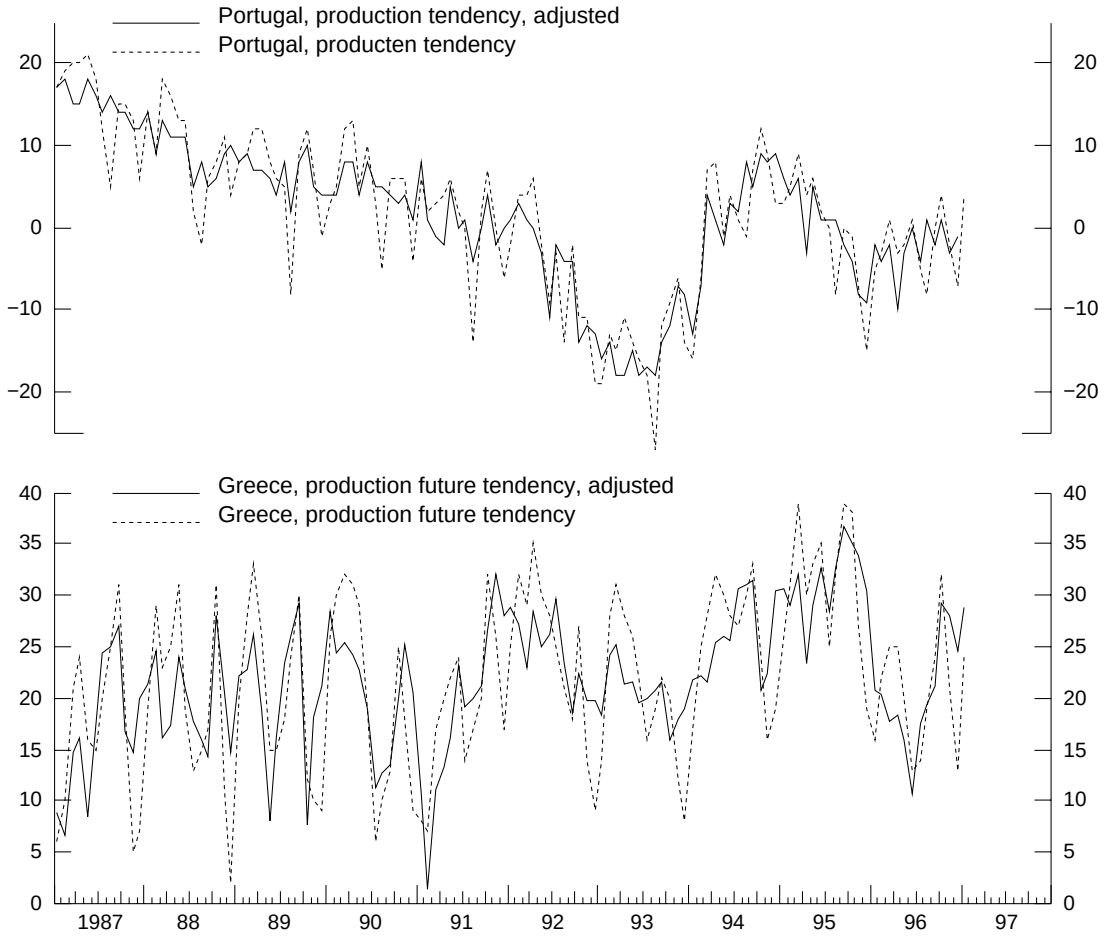
Seasonality and smoothness

In general, answers to business surveys are "seasonally adjusted" by the respondents. This adds to the relative smoothness of the indicators. For qualitative indicators based on business surveys, MCD statistics are usually significantly smaller than for corresponding quantitative indicators. However, respondents are not able to completely eliminate the seasonal variations from their replies. In the OECD system all survey series are tested for remaining seasonality and if necessary adjusted. The criterion used is the result of the stable seasonality test carried out as part of the U.S. Bureau of Census X-11 seasonal adjustment program.

Most business survey series contain only a little seasonal variation but the variation may be quite strong for certain series in some countries. To illustrate this, survey data for Portugal and Greece on production tendency and production expectations, respectively are shown in Chart 7 in both unadjusted

and seasonal adjusted form. In particular, the production series for Greece contains a strong seasonal pattern and shows the importance of adjusting the data for seasonal variation.

CHART 7 SURVEY DATA AND SEASONALITY



4.3 Practical and statistical considerations

Revisions

It is very important that the series are not revised to a significant extent in later periods if they are to be used for analysing the present economic situation and for forecasting. Business survey series rarely are revised whilst in many countries preliminary data for conventional statistics are released very quickly but later revised up to three times. For a few indicators - in particular indices of production and new orders - about 30-40 per cent of the forecasting errors are due to revisions of the first published data in some countries.

Timeliness of publication

Prompt availability is an obvious requirement of a good cyclical indicator and a key element of a leading indicator. Business survey results are usually available 2-3 weeks after the period under consideration is over. This is due to the fact that the information is qualitative in nature and the sample size relatively small. Thanks to the rapid availability of the business survey results in many countries it is possible to calculate a composite leading indicator with a high weight of components included for most countries covered by the OECD system about five weeks after the end of each month.

Statistical basis

A sound statistical basis is a crucial criterion when dealing with information in countries where the statistical system as well as the economic system are undergoing significant change. In particular, the recording of private sector activity and introduction of sample surveys to collect information from the growing number of private enterprises affect the reliability of basic statistics.

The qualitative nature of the information collected by business surveys means that a relatively smaller sample is sufficient to gain meaningful results on changes in the variables compared to data derived from quantitative surveys. This is explained in the first place by the fact that the sample size depends on the variance of the different variables and secondly, by the fact that the variance of changes in variables based on panel data is as a rule significantly smaller than in the case of data derived from surveys that measure levels.

The smaller sample size and the fact that qualitative information is easier for the enterprises to supply should give more reliable information in the sense that it should be easier to cover the expanding private sector and to reduce non-response.

The leading indicators used most frequently in the OECD system and their characteristics are set out in Table 6. They include four business survey series in the top ten series. These concern: stocks, production, order books and new orders. These variables could almost certainly be used as leading indicators in transition countries.

The points raised above suggest that these types of business survey indicators may be the most appropriate choice for many transition countries during the transition period.

5. COMPOSITE INDICATORS

Once a set of cyclical indicators has been selected it useful to combine them into a single composite indicator. The same principles can be used to determine a single reference or coincident composite indicator and a leading or lagging composite indicator. This is done in order to reduce the risk of false signals, and to provide a cyclical indicator with better forecasting and tracking qualities than any of its individual components.

The reason why a group of indicators combined into a composite indicator should be more reliable over a period of time than any of its individual components is related to the nature and causes of business cycles. Each cycle has its unique characteristics as well as features in common with other cycles. But no single cause explains the cyclical fluctuation over a period of time in overall activity. The performance of individual indicators will then depend on the causes behind a specific cycle. Some indicators will perform better in one cycle and others in a different cycle. It is therefore necessary to have signals for the many possible causes of cyclical changes, i.e. to use all potential indicators as a group.

The method used to calculate the OECD composite leading indicators from de-trended components is described in detail in the first part of this section. A summary of some alternative methods is presented in the second part.

5.1 The OECD method

Periodicity

The de-trended indicator series are all converted to a monthly basis. Most indicators used in the OECD system are in fact monthly series but it is sometimes necessary to accept quarterly data. These are converted to monthly frequency by linear interpolation.

Smoothing

It is necessary to ensure that all component series have equal “smoothness”. This is to ensure that month-to-month changes in the composite indicator are not unduly influenced by irregular movements in any one indicator series. The OECD procedure is to use the "Months for Cyclical Dominance" (MCD) moving average. This procedure ensures approximately equal smoothness between series and also ensures that the month-to-month changes in each series are more likely to be due to cyclical than to irregular movements. The data lost at the end of the series due to the moving average are restored with an extrapolation by regression over the end of the series.

Normalisation

The next step is to normalise the series so that their cyclical movements have the same amplitude. If this were not done series with particularly marked cyclical amplitude would have undue weight in the composite indicator. The method used to calculate normalised indices is, for each

component series, is first to subtract the mean and then to divide by the mean of the absolute values of the difference from the mean. The normalised series are then converted into index form by adding 100.

Lagging

Finally, it may sometimes be necessary to lead or lag particular indicators. In the OECD system this is done in only one case, where the indicators selected for a particular country fall into two distinct groups of "longer-leading" and "shorter-leading" indicators. Combining the two types of indicators gave unsatisfactory results because of the interference between the two cycles. The alignment was improved by lagging the longer-leading group of indicators.

Weighting

The indicator series having now been de-trended, converted to a monthly basis, smoothed, normalised and, possibly, lagged to improve alignment, are then ready to be combined into a single composite indicator. At this stage it would be possible to assign different weights to the component series depending, for example, on their past record in forecasting and tracking cycles or their relative freedom from revisions. In the OECD system, equal weights are normally used to obtain each country's composite indicator. This does not mean that there is no weighting in the OECD system, because equal weighting implies, by default, a judgement on appropriate weights, and the normalisation process is itself a weighting system in reverse. However, when the composite indicators for individual countries are combined into indicators for country groups, each composite indicator is assigned the weight used in calculating group totals for the industrial production index.

Aggregation

The raw composite index is obtained by averaging the normalised indices of each component series. A composite index calculated on an incomplete set of data is linked to the body of the index by use of a linking factor which is equivalent to applying the growth-rate of the "incomplete" index to the last point at which a full index is available.

Amplitude adjustment and trend restoration

The final composite index is presented in a form which makes it more readily comparable with the reference series. Two adjustments are made to the raw composite index to give it the same form of the cyclical component and the same trend as the reference series. Amplitude adjustment is carried out by adjusting first the mean to unity and then adjusting the cyclical amplitude of the composite index to agree with that of the de-trended reference series by means of a scaling factor. Trend restoration is done by multiplying the amplitude adjusted composite index by the trend of the reference series in its original units.

5.2 Alternative methods

The OECD system differs in a number of aspects from other indicator systems published by national governments, economic research institutes and other international institutions. In the following paragraphs some of the basic steps for the calculation of a composite index are outlined and differences in methods applied by different institutions are described. The institutions covered in addition to the OECD are the U.S. Department of Commerce (in their initial work), Centre for International Business Cycle Research (CIBCR), and the Commission of the European Communities (EC).

Trend estimation

All of the international indicator systems covered here uses the "growth cycle" or "deviation-from-trend" approach. Trend estimation is thus a crucial step in detecting cyclical movements and identifying turning points. However, the U.S. Department of Commerce in their initial work used the "business cycle" approach and defined turning points in the levels of series.

Trend estimation in the U.S. Department of Commerce and CIBCR systems is not performed directly but implied by using month-to-month changes either in percentage form or differences as input to the composite index calculation. This method is also used in the EC system for all component series with the exception of the share price index where the original NBER method is used to de-trend the share price index.

Normalisation

The method of normalisation used in the US Department of Commerce, CIBCR and EC systems is to reduce each component series so that their average month-to-month changes are equal, i.e. by dividing the month-to-month changes with the average month-to-month change. This method however gives little weight to the more irregular series in the cyclical movement of the composite index, unless some prior ad-hoc smoothing is performed. In contrast in the OECD system the amplitudes of the cyclical movements are normalised but the relative magnitude of the irregular movements are unchanged.

Weighting

The U.S. Department of Commerce, CIBCR and the OECD system use an equal weighting system once the components have been selected.

Different weights are however used in the EC system. The components are divided into two groups with equal weights to components in each group. The first group contains the industrial confidence indicator and the consumer confidence indicator, and the second group includes the construction confidence indicator and the share price index. The components in the second group are given half the weight of the components in the first group.

5.3 Components used in international systems of leading indicators

EC leading indicators

A standard set of leading indicators is used in the EC system. This set is mainly based on qualitative data from business or consumer tendency surveys. The EC leading indicator, i.e. the economic sentiment indicator combines the following component series:

- industrial confidence indicator;
- construction confidence indicator;
- consumer confidence indicator;
- share-price index.

The industrial confidence indicator is the arithmetic average of the answers (balances) to the question on production expectations, order-books and stocks of finished goods (inverted).

The construction confidence indicator is the arithmetic average of the answers (balances) to the questions on order-books and employment expectations.

The consumer confidence indicator is the arithmetic average of the answers (balances) to the four questions: on the financial situation of households; general economic situation (past and future); and the question on the advisability of making major purchases (of consumer durable).

CIBCR leading indicators

The leading indicator series included in the composite leading indicators of the CIBCR are selected to fit, as far as possible, the standard set of indicators used in the composite indicator for the United States. It has not, however, been possible to obtain a complete standardised set across countries and deviations have been accepted. The basic set of leading indicators includes the following twelve series:

1. average workweek, manufacturing;
2. new employment claims;
3. new orders, consumer goods;
4. formation of business enterprises;
5. contracts and orders, plant and equipment;
6. building permits, housing;
7. change in business inventories;
8. change in industrial material prices;

9. share price index;

10. profits;

11. ratio, price to labour cost;

12. change in consumer debt.

The above series not included in the composite leading indicators for individual countries are identified in the following table by country and series number.

Table 7: Series not included in CIBCR leading indicators

Excluded series - refer above	2	3	4	5	6	7	8	9	10	11	12
Canada			*								
United Kingdom	*	*									
Germany		*									
France			*	*					*		*
Italy	*			*		*			*		*
Japan	*	*									
Australia	*	*				*					
Taiwan	*		*	*		*	*		*	*	*
South Korea	*	*	*		*	*	*		*	*	*
New Zealand	*		*						*		
New Zealand											

For some countries many deviations from the standard set of series are allowed especially for Taiwan and South Korea. The missing series have been replaced with other leading indicator series for these two countries. New series for Taiwan are the value of exports and money supply (M1). Additional leading indicators for South Korea include the accession rate index, manufacturing, letter of credit arrivals and inventories to shipments (inverted).

OECD leading indicators

The OECD system does not use a standard set of leading indicators for all countries. The different subject areas from which the leading indicator series are chosen are set out in Table 2. Certain types of series however regularly recur in the list of leading indicators for different countries. The most frequently used series are business survey series, monetary and financial series, quantitative series relating to stocks and orders, construction, retail sales, prices and foreign trade series.

The main leading indicator series used in the different international indicator systems are set out in Table 8. The major difference between the systems in terms of types of series used is the degree of dependence on qualitative business survey data. In the case of the EC system this is almost total, the only quantitative series used is the share price index; in the OECD system they are the most frequently used leading indicator series, but in the CIBCR system they are not used at all.

Apart from the difference in use of series from business surveys, the use of two other statistical series further distinguish between the various indicator systems. The OECD system is the only one to include series from the foreign trade area, i.e. exports and terms of trade series, and to cover series related to activity in foreign countries.

A further major difference between the indicator systems is the use of money supply as a leading indicator for most countries in the OECD system. This series is not used in any of the other systems. The use of series such as money supply, deposits and the above series related to foreign trade and activity in foreign countries means that the OECD system include series of the "prime movers" type which are relevant to monetary and fiscal policies and foreign economic developments.

Table 8: International Systems of Leading Indicators-Main leading indicators

Indicator series by subject area	Number of countries with indicators		
	OECD	CIBCR	EC
Production, stocks and orders			
Industrial production branches	4		
Orders	4	5	
Stocks	6	7	
Construction, sales and trade			
Construction	9	10	
Sales or registration of vehicles	5		
Retail sales	5		
Labour force			
Layoffs/initial claims	2	4	
Hours worked	2	8	
Prices, costs and profits			
Wages and salaries per unit of output	3		
Ratio, price to labour cost		9	
Price indices	5	8	
Profits, flow of funds, etc.	2	6	
Monetary and financial			
Consumer debt		7	
Foreign exchange holdings	2		
Deposits/credits	4		
Money supply	17		
Interest rates	11		
Share prices	12	11	12
Company formation	1	6	
Foreign trade			
Exports	3		
Terms of trade	8		
Business surveys			
General situation	6		12
Production	12		12
New orders	8		12
Order books	10		12
Stocks	13		12
Employment			12
Financial situation of households			12
Purchases of households			12
Economic activity in foreign countries			
Foreign series	4		

5.4 Survey indicators and composite indicators

Composite indicators based only on business survey information are included in many surveys or calculated from survey information in many OECD countries. The EC leading indicator, i.e. economic sentiment indicator presented above gave one example of such an approach, if the share-price component is excluded.

The type of approach used in the EC system may be labelled internal, in the sense that the composite index is based on survey information that is internal to the reporting enterprise or household. Composite indicators of this type, but with other combinations of questions, are calculated from national surveys in Belgium, Germany and Switzerland. The composite survey indicator for Belgium follows in part the standard method for the construction of composite indicators outlined above and is based on ten survey questions. The German indicator combines answers to two questions about the business situation at present and 6 months ahead. The geometric average of the two seasonally adjusted balances is calculated to give the composite index. In the case of Switzerland, four to six questions on the developments concerning production, order books and order inflow over the past twelve months and judgements on the present level of order books, stocks of finished goods and stocks of materials make up the composite index, which is a simple arithmetic average of the balances.

Questions on the general business situation for the enterprise may be considered as composite indicators in their own right in the sense that they combine factors determining the respondents' appraisals concerning order books, expected orders inflow, customers' situation and profit possibilities. This type of question is asked in Belgium, Germany, Japan, Finland, Norway and Switzerland.

Another approach which may be called external, is when a question in the survey asks for information that is external to the reporting enterprise or household, such as the general economic situation in the country, industrial sector or industry. A question of this type is asked in Australia, New Zealand, France and Italy.

6. FORECASTING ABILITY OF OECD LEADING INDICATIONS

6.1 Predicting turning points

The main objective of the OECD composite leading indicators is to predict cyclical turning points. However, the system was designed also to provide information about the likely rate and amplitude of movement in the reference series at all stages of the cycle.

The historical performance of a composite indicator or any cyclical indicator can be evaluated with different characteristics: the behaviour of the indicator in relation to the cyclical turning points of the reference series and the extent to which the cyclical profiles of indicator and reference series resemble each other (see Section 3.2). The historical performance is in general reasonably reassuring for countries covered by the OECD system. This is also the case for first published composite indicators which may be based on only a subset of the component series and when some or all of the components may be preliminary figures which will subsequently be revised.

This section considers how composite indicators can be used to predict turning points in the reference series. The historical measures calculated for the composite indicators concerning average lead and variability of lead give only a broad guide to this question. It is difficult to detect a turning point in advance with only the help of the de-trended composite indicator itself, and several derived measures are usually used for this purpose. It should be noted that all measures described below are not used in the OECD system, only the percentage change measures are calculated on a regular basis. The following derived measures are considered:

- the one-month percentage change of the composite leading indicator;
- the six-month percentage change, at an annual rate, of the composite leading indicator and the reference series;
- the normal pressure ratio, which is the simple ratio of the composite leading indicator to the reference series;
- the percentage change pressure ratio, which is the ratio of the six-month percentage change of the composite leading indicator to the reference series. The ratio is calculated by expressing the percent changes in both series as differences from 100 per cent, to take care of problems with discontinuities caused by sign changes and division by zero.

All these measures give advance warning of approaching cyclical turning points. The percentage change series displays turning points about six months ahead in the case of regular well-behaved symmetrical cycles but may not do so when the original series has skewed cycles and sub-cycles. The normal pressure ratio adds about 50 per cent to the lead time of the composite leading indicator and is a measure of the extent to which the composite indicator has out-stripped the reference series. The

percentage change pressure ratio is a measure that combines the effect of the percentage change series and the normal pressure ratio.

An illustration of the evolution of the last three of these measures is provided in Chart 8. This is shown for the United States for the period 1963 to 1985. The de-trended composite leading indicator and the reference series are also shown.

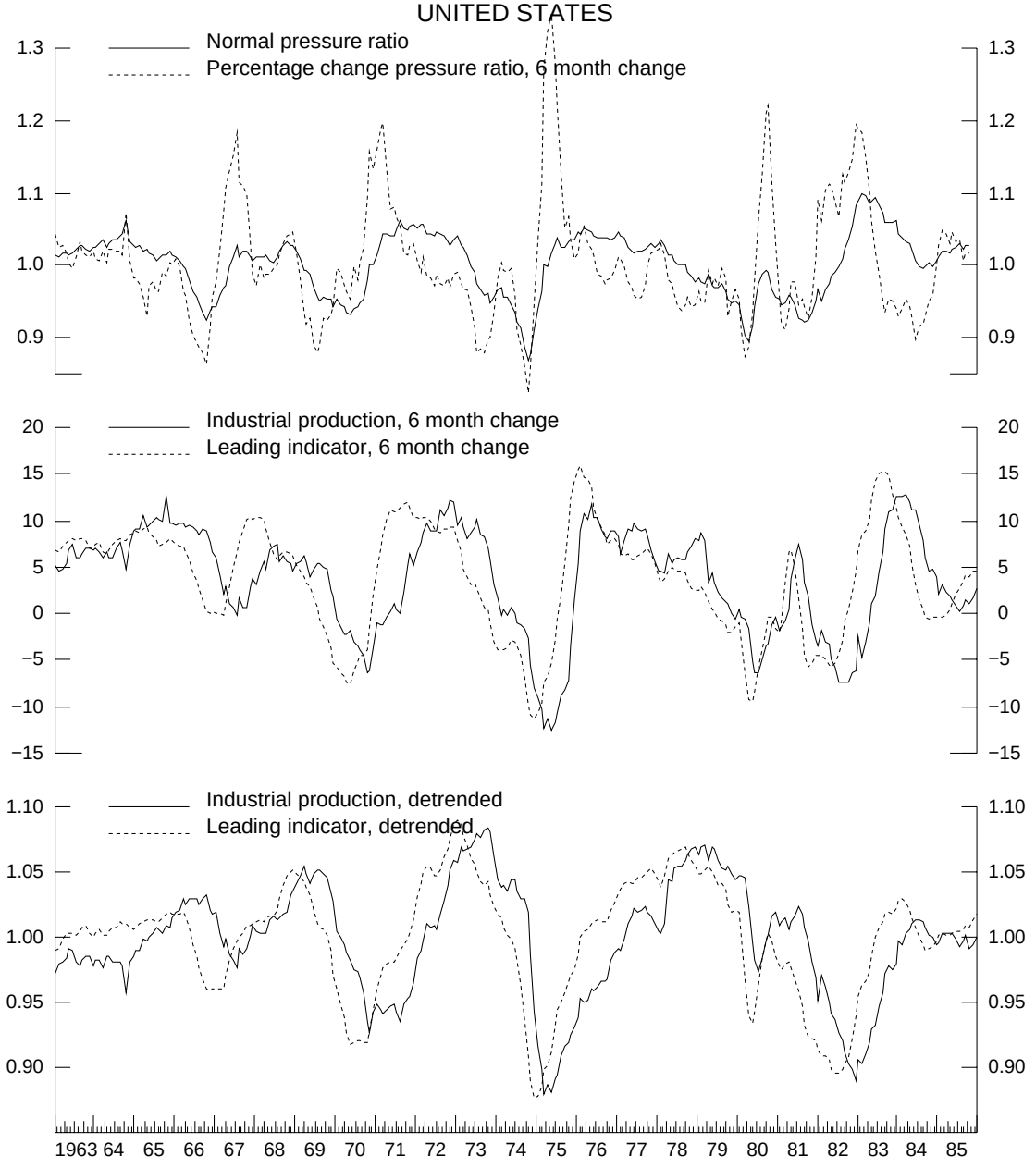
The usual method of deciding if a peak (trough) in the reference series has occurred is to examine the composite index to see if it has been above (below) its previous high (low) for a specified number of months. This approach will work well if the composite index is smooth and not subject to large revisions. Revisions and random movements do, however, affect the composite index. To take care of this as far as possible the following rules have been adopted for the calculation of growth cycle signals based on the above measures:

- for the six-month percentage change series as well as the pressure ratios, a peak signal is indicated when the change or ratio goes below minus 1 per cent and a trough signal when the change or ratio goes above plus 1 percent;

- for the one-month percentage change series a three-month rule is applied, that is, a peak (trough) signal is indicated when the change is below (above) zero for the third consecutive month.

In practice, over the period from 1960 to 1983, all these derived measures, except the normal pressure ratio, have successfully predicted all cyclical turning points, although as noted below they have also provided a number of false signals - indications of approaching peaks and troughs that in the event did not materialise.

CHART 8 FORECASTING WITH LEADING INDICATORS
UNITED STATES



The results presented in Table 9 show the median lag at turning points in the reference series for all derived measures during the period, starting between 1960 and 1965 and ending in 1982 or 1983 for Canada, United States, Japan, France, Germany, Italy, United Kingdom and the OECD total area. Even if the median lags do not seem to be very long in some cases, they should be compared with the median lag for the six-month percentage change in the reference series. This is because this series shows the earliest confirming signal for a turning point. In the case of Japan, for example, the normal pressure ratio series actually lagged the trough turning point in industrial production by one month on average throughout the period, but the signals produced by this measure were, on average, still available three months before the turning could have been confirmed from the behaviour of the industrial production index itself.

Table 9 provides evidence of the ability of the derived measures to indicate approaching turning points and to confirm them. The measures did, however produce a number of extra or missing turning points over the same period, as can be seen from Table 10**.** Missing turning points are most frequent in the normal pressure ratio, which is the most stable measure and signals only major cyclical changes. None of the other measures failed to signal any major turning point.

A more frequent problem is the number of extra turning points. The percentage change pressure ratio indicates the greatest number of extra turning points, closely followed by the one-month percentage change series. The reference series itself, on a six-month basis, also indicates a large number of extra turning points, which underscores the difficulty in obtaining reliable current confirmation of turning point signals. The best record concerning extra and missing signals at all turning points is shown by the six-month percentage change measure.

Given the problems with extra and missing signals, all derived measures must be used with care. They all however give some information about approaching or current turning points and in combination they can be used to monitor cyclical developments.

Table 9: Median lag, in months, of derived measures for composite leading indicators (LI) and industrial production (IP) used to signal and confirm growth cycle peaks and troughs,

1960/63-1982/83

Peak Signals

Median lag (+) in months

	1-month % change in LI	6-month % change in LI (1)	Normal pressure ratio (2)	Percent change pressure ratio (3)	6-month % change in IP
Canada	-3	-1	-1	-8	+5
United States	-5	-4	-3	-6	+2
Japan	-2	-1	-3	-8	+4
France	-2	0	+1	-8	+5
Germany	-3	-2	-1	-10	+5
Italy	+2	+1	+1	-7	+6
United Kingdom	-2	-7	-6	-15	+3
OECD Total	-2	0	+3	-5	+5

Trough Signals

Median lag (+) in months

Canada	-3	-4	-2	-8	+3
United States	-1	0	-1	-2	+4
Japan	-2	+1	-1	-4	+4
France	-3	-1	+5	-5	+5
Germany	-2	0	0	-8	+4
Italy	-3	-1	+2	-6	+4
United Kingdom	-7	-6	-2	-12	+3
OECD Total	-2	0	-1	-4	+5

(1) 6-month percent change at annual rate in amplitude adjusted series.
(2) Straight ratio of leading indicator to industrial production.
(3) Ratio of 6-month percent change, annual rate.
(4) Growth cycle turning points in industrial production.

Table 10: Number of extra or missing growth cycles signals in leading indicators (LI) and industrial production (IP), 1960/63-1982/83

Peak Signals

X = extra signals, M = missing signals

	1-month % change in LI		6-month % change in LI (1)		Normal pressure ration (2)		Percent Change pressure ratio (3)		6-month % change in PI		Number of reference turning points (4)
	X	M	X	M	X	M	X	M	X	M	
Canada	3					2	2		3		8
United States	1			1		3	2	1	1		8
Japan	2					2		1			8
France							1				6
Germany	2					1	1				5
Italy			1				3		4		5
United Kingdom	7		1		1		4		1		5
OECD Total				1		3	1			1	8

Trough Signals

X = extra signals, M = missing signals

Canada	3					2	2		3		8
United States	1			1		2	2	1	1		8
Japan	2					2		1			8
France							1				7
Germany	2					1	1				6
Italy	1		1				3		4		6
United Kingdom	7		1		1		4		1		5
OECD Total						2	1			1	9

(1) 6-month percent change at annual rate in amplitude adjusted series.
(2) Straight ratio of leading indicator to industrial production.
(3) Ratio of 6-month percent change, annual rate.
(4) Growth cycle turning points in industrial production.

6.2 Using the indicators

The discussion above suggest the following guidelines as how the measures can be used to signal approaching and current turning points. In a normal case, the signals will appear sequentially in the following order: the first signal will appear in the percentage change pressure ratio, followed by a second signal in the leading indicator, on a six-month basis and/or in the leading indicator on a one-month basis. A third signal will then appear in the normal pressure ratio, and finally, the turning point will be confirmed by a signal in the reference series, on a six-month basis.

If the first signal appears in the percentage change pressure ratio, it should however not be considered as a definitive signal until it is followed by a second signal in the leading indicator, on a six-month basis. This rule should be followed in all cases.

The same rule will govern the second signal, if it first appears in the leading indicator on a one-month basis. This signal should not be taken as definitive unless it is closely followed, within one or two months, by a signal in the leading indicator on a six-month basis.

If the second signal, announced by the leading indicator on a six-month basis, is followed by a third signal in the normal pressure ratio, then it is almost certain that a major turning point is coming.

Charts 9 to 12 illustrate how the system worked for the trough in November 1982 for the United States. The first signal (TI) appeared in the percentage change pressure ratio in December 1981, a lead of eleven months (Chart 12). A second signal (T2) appeared in the leading indicator on a six-month basis in June 1982, a lead of five months (Chart 10). The third signal (T3) showed up in the normal pressure ratio in August 1982, a lead of three months (Chart 11). Finally, the trough was confirmed by a signal (T4) in the reference series in January 1983, a lag of two months (Chart 10).

In all, the system gave a sequence of turning point signals ranging from eleven to three months in advance of the trough in November 1982 (Chart 9), which was confirmed by the reference series in January 1983.

In the case of the United States, additional signals could have been obtained from the "longer-leading" and "shorter leading" composite indicator versions. The longer-leading indicator showed a trough signal (TL) in January 1982, a lead of ten months (Chart 12). The shorter-leading indicator (TS) confirmed the trough in November 1982, coinciding with the later defined trough at that date (Chart 12). Chart 13 illustrates the evolution of the different composite leading indicators for the United States and the reference series over the period 1965 to 1996.

Insert chart 9-12, i.e (chart R to U)

CHART 13 SHORTER AND LONGER LEADING INDICATORS
UNITED STATES